A Study of
THYROID MALIGNANCIES

Dissertation submitted to

THE TAMILNADU
DR. M.G.R. MEDICAL UNIVERSITY
CHENNAI – 600 032

with fulfillment of the Regulations
for the Award of the Degree of

M.S. GENERAL SURGERY
(BRANCH – I)

DEPARTMENT OF SURGERY
KILPAUK MEDICAL COLLEGE
CHENNAI – 600 010

MARCH – 2008

CERTIFICATE

This is to certify that this dissertation in **"A STUDY OF THYROID MALIGNANCIES"** is a work done by **DR. BALA NATARAJAN,** under my guidance during the period 2005-2007. This has been submitted in partial fulfillment of the award of M.S. Degree in General Surgery (Branch – I) by the Tamilnadu Dr. M.G.R. Medical University, Chennai – 32.

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ACKNOWLEDGEMENT

I thank the DEAN of Kilpauk Medical College and Hospital, **Prof. Dr. M. DHANAPAL, M.D., D.M., (Cardiology)** for permitting me to conduct this study in the Department of General Surgery of the Government Kilpauk Medical College and Hospital, Chennai.

I thank **Prof. Dr. R.N.M. FRANCIS, M.S.,** Head of Department of General Surgery, for helping and guiding me during the study.

I am grateful to **Prof. G. GUNASEELAN, M.S.,** for his valuable suggestions and guidance.

I thank **Prof. P. KULOTHUNGAN, M.S.,** who has been my teacher and mentor and under whose guidance I have had the privilege of working as a postgraduate student.

I am greatly indebted to the Assistant Professor of my Surgical Unit **Dr. V. RUKMAANGADAN, M.S., Dr. M. ALLI, D.G.O., M.S.,** and **Dr. V. KOPPERUNDEVI, D.G.O., M.S.,** who have encouraged me and guided me during my postgraduate course and in this study.

I thank the Department of Surgical Oncology, Government Royapettah Hospital, the Department of Pathology, Government Kilpauk Medical College and Government Royapettah Hospital and the Department of Medical Oncology and Radiation Oncology, Government Royapettah Hospital for their valuable help.

Finally, my heartfelt thanks to my patients who have been the source of my knowledge and to whom this study is dedicated.

CONTENTS

INTRODUCTION

Thyroid carcinoma is a fascinating tumor because of the diversity in the tumor presentation and behaviour. It is a relatively rare tumor, though it is the most common endocrine malignancy. The incidence of thyroid malignancy is rising rapidly. This may be due to the large number of incidentalomas found during routine head and neck evaluations and better investigatory procedures available now.

Thyroid cancer is a heterogenous disease that affects all age groups. The tumors are found to be more aggressive in the elderly. Controversy still exists over the treatment of this cancer because of the long term survival of patients with differentiated thyroid cancers irrespective of the type or extent of treatment. A high index of suspicion is required for the diagnosis of these cancers.

Undifferentiated thyroid cancers continue to have a dismal prognosis. Anaplastic thyroid carcinoma remains one of the most difficult human malignancies to treat and is highly lethal.

Medullary thyroid cancer is one of the best characterized solid malignancies. The genetic abnormalities in these patients can be diagnosed accurately. This can be used to detect and treat patients with familial gene mutations at an earlier stage.

The knowledge base about thyroid malignancies is continuously evolving and may lead to better treatment options in the future.

AIM OF STUDY

1. To study the epidemiology of thyroid cancers.

2. To study the prevalence of the different types of thyroid cancers

3. To analyse the clinical presentations of malignant thyroid neoplasms

4. To evaluate the various modalities for treatment of thyroid cancer

5. To study the role of neck dissections in thyroid cancers.

6. To analyse the role of TSH suppressive treatment with thyroxine for malignancies of thyroid.

7. To evaluate the outcome of patients treated for thyroid malignancies.

REVIEW OF LITERATURE

HISTORICAL BACKGROUND

- The word Goitre is derived from the Latin word 'Guttur' which means throat. Goitres have been recognized since 2700 BC (14).

- The name thyroid is derived from the Greek word thyreoeides meaning shield shaped. This name was given by Thomas Wharton in his work 'Adenographia' in 1656 (14).

- Iodine – rich seaweed was used for treatment of goiter.

- First account of thyroid surgery was by Roger Frugardi in 1170 (14).

- Two surgeons contributed greatly to the advancement of thyroid surgeries. They were Emil Theoder Kocher (1841-1917) and C.A. Theodor Billroth (1829-1894).

- In recognition 'For his work on physiology, pathology and surgery of the thyroid gland' Kocher was awarded the Nobel Prize in 1909.

- Felix Simon recognized that myxedema is due to loss of thyroid function.

- Myxedema was effectively treated first by George Murray in 1891.

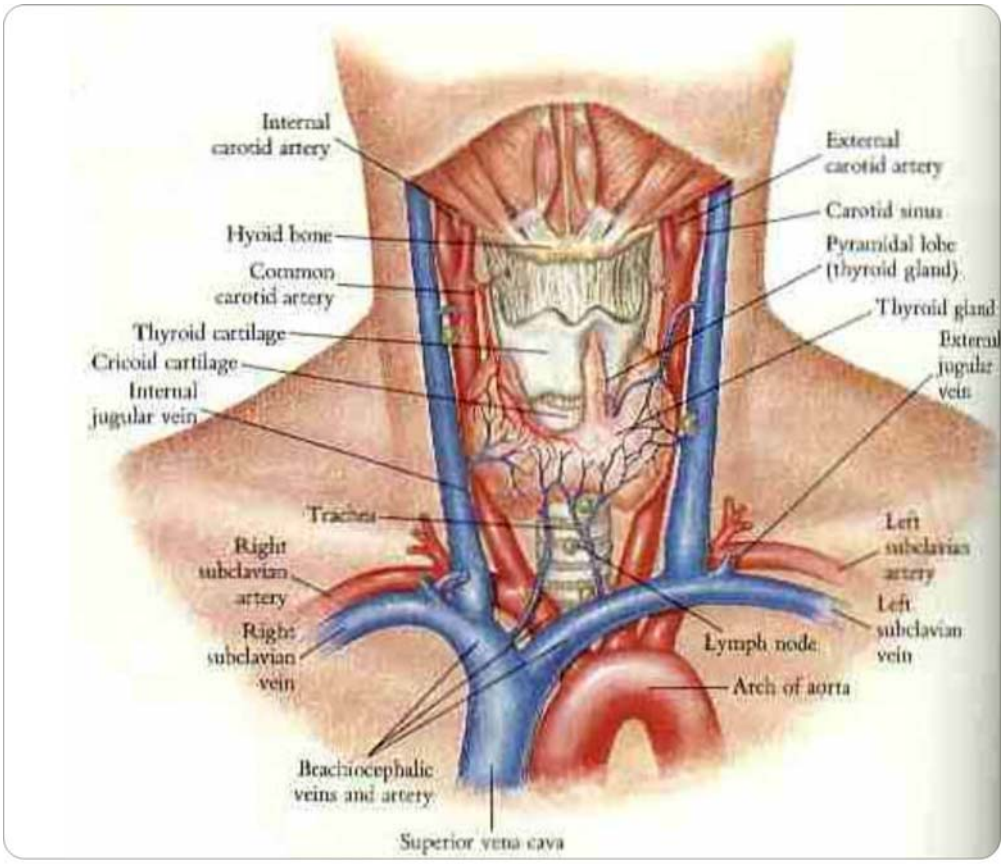
- Oral therapy for hypothyroidism was later introduced by Edward Fox.

- Edward Kendall isolated the bioactive material from the thyroid in 1914.

- William Halstead revolutionized surgical treatment and education and contributed greatly to the operative treatments of the thyroid gland.

EMBRYOLOGY

The thyroid gland arises as a midline diverticulum from the floor of the primitive foregut around the 3rd week of gestation (14). Endodermal cells in this region thicken to form the medial thyroid anlage. This descends in the neck anterior to the hyoid bone and larynx. The original attachment to the pharynx is in the oral cavity at the foramen cecum. The anlage remains connected to the foramen cecum by an epithelial lined tube known as the thyroglossal duct. The epithelium of the anlage gives rise to the thyroid follicular cells. Lateral anlages arise on both sides from the fourth branchial pouch and fuse with the median anlage at fifth week of gestation. The lateral anlages are neuroectodermal in origin. They form the parafollicular or 'C' cells. Thyroid follicles appear at 8 weeks of gestation. Colloid formation begins by the 11th week of gestation.



ANATOMY OF THYROID

SURGICAL ANATOMY

The normal thyroid gland consists of right and left lobes that are joined to each other by the isthmus. A pyramidal lobe which is found in about 50% of people represents the distal end of the thyroglossal duct. The gland is brown in colour and firm in consistency. In weighs approximately 20 g (14). The thyroid lobe extends from mid-thyroid cartilage superiorly and lies adjacent to the carotid sheath and sternomastoid muscles laterally. The isthmus lies in front of the second and third tracheal rings. The thyroid gland has two capsules; a true capsule which is the peripheral condensation of the connective tissue of the gland and a false capsule which is formed by the pretracheal layer of deep cervical fascia. This false capsule is thickened posteriorly where it forms the suspensory ligament of berry which is attached to the cricoid cartilage (7).

ARTERIAL SUPPLY

The thyroid is a highly vascular organ. It is supplied by four main arteries two superior and two inferior thyroid arteries.

SUPERIOR THYROID ARTERIES

The superior thyroid artery is the first branch of the external carotid artery. It descends medially on the surface of the inferior constrictor muscle

and enters the superior pole of the thyroid gland before which it divides into anterior and posterior branches.

INFERIOR THYROID ARTERIES

The inferior thyroid artery is a branch of the thyroicervical trunk. It passes behind the carotid sheath and in front of the vertebral vessels as it travels upwards. It then turns medially and enters the thyroid gland posteriorly.

THYROIDEA IMA ARTERY

It arises directly from the aorta or innominate artery in 1-4% of individuals (14). It enters the lower part of the isthmus.

ACCESSORY THYROID ARTERIES

These arise from the tracheal and esophageal arteries and supply the thyroid.

VENOUS DRAINAGE

The venous drainage of the thyroid gland is via multiple small surface veins which coalesce to form 3 sets of veins: the superior, middle and inferior thyroid veins. The superior thyroid veins accompany the superior thyroid arteries and drain into the internal jugular vein. The middle thyroid veins are least consistent-they course immediately laterally into the internal jugular vein. The inferior thyroid veins are usually 2 to 3 in number and drain into the

branchiocephalic veins. A fourth thyroid vein (of Kocher) may emerge between the middle and inferior veins and drain into the internal jugular vein.

LYMPHATIC SYSTEM

Lymphatic channels are present beneath the capsule of the gland and communicate between the lobes through the isthmus. The lymphatics drain into the regional lymph nodes which are the pretracheal, paratracheal, tracheobronchial nodes, mediastinal nodes in anterior and superior position, upper, middle and lower jugular nodes, retropharyngeal and esophageal nodes.

NERVES

The sympathetic innervation is from the superior and middle cervical sympathetic ganglia. The sympathetics are vasomotor in action. Parasympathetics are derived from the vagus nerve and reach the gland via branches of the laryngeal nerves.

RELATIONSHIP OF RECURRENT LARYNGEAL NERVE

The left recurrent laryngeal nerve arises from the vagus where it croses the aortic arch, loops around the ligamentum arteriosum and ascends medially in the neck within the tracheoesophageal groove. On the right side, the nerve arises from the vagus at its crossing with the right subclavian artery. Its course is more oblique than the left.

The nerve may be non recurrent in 0.5-1% of patients. This is more common on the right (14).

The recurrent laryngeal nerves may branch or pass anterior or posterior or interdigitate with branches of inferior thyroid artery. They enter the larynx on the caudal border of the cricothyroid muscle. Here the nerves are in close proximity to the superior parathyroid, the inferior thyroid artery and the most posterior aspect of the thyroid. It is essential to identify the entire course of the nerves in the neck during thyroid surgeries.

The recurrent laryngeal nerve supplies all the intrinsic muscles of the larynx except the cricothyroid. Damage to the nerve causes ipsilateral vocal cord paralysis.

RELATIONSHIP OF THE SUPERIOR LARYNGEAL NERVE

The superior laryngeal nerves arise from the vagus nerves. They originate at the base of the skull and travel along the internal carotid artery. They divide into two branches at the level of the hyoid bone the internal and external laryngeal nerve. The external laryngeal nerve descends alongside the superior thyroid vessels before supplying the cricothyroid muscle. Injury to the nerve during surgery causes alteration in the pitch of the voice.

PHYSIOLOGY OF THE THYROID GLAND

Thyroid hormones affect almost every system in the body. They increase oxygen consumption, basal metabolic rate and heat production in various tissues. They help to regulate the lipid and carbohydrate metabolism. They are necessary for normal growth and maturation.

The main hormones secreted by the thyroid are thyroxine (T4) and triiodothyronine (T3). T3 is also formed by deiodination of T4 in peripheral tissues.

IODINE METABOLISM

Iodine is the mineral required for thyroid hormone synthesis. The average daily requirement is 100-150 micrograms (6). The thyroid is the storage site of greater than 90% of the body's iodine content. Iodide is actively transported into the thyroid follicular cells by an ATP dependent process.

Thyroid Hormone synthesis

The thyroid cells have 3 functions

1. They collect and transport iodine

2. They synthesize thyroglobulin and secrete it into colloid

3. They remove the thyroid hormones from thyroglobulin and secrete them into the circulation

In the thyroid gland, iodide is oxidized to iodine and bound to 3 positions of tyrosine residues that are part of the thyroglobulin molecule in the colloid. Thyroglobulin is synthesized in the thyroid cells and secreted into the colloid by exocytosis of granules that also contain thyroid peroxidase. This enzyme catalyzes the oxidation of iodide and its binding. The thyroid hormones remain a part of the thyroglobulin till they are secreted. When they are secreted, colloid is ingested by the thyroid cells, the peptide bonds are hydrolyzed, and free T4 and T3 are released into the capillaries.

In the process of hormone synthesis, monoiodotyrosine (MIT) is produced first. It is next iodinated in the fifth position to form diiodotyrosine (DIT). Two molecules of DIT undergo oxidative condensation to form T4. T3 is formed by condensation of DIT with MIT. The average distribution of these compounds in the normal thyroid is 23% MIT, 33% DIT, 35% T4 and 7% T3 (6).

SECRETION

The human thyroid secretes 80 μg of T4, 4 μg of T3 and 2 μg of RT3 per day. MIT and DIT are not secreted. The thyroid cells ingest colloid by endocytosis. In the cells, the globules of colloid merge with lysosomes. The peptide bonds between the iodinated residues and thyroglobulin are broken by

the proteases in the lysosomes. T4 and T3 are liberated and are released into the circulation. The iodine associated with the MIT and DIT is liberated by the deiodinase enzyme and is reutilized for thyroid hormone synthesis.

TRANSPORT AND METABOLISM

The normal total plasma T4 level is approximately 8 μg/dl and the plasma T3 level is approximately 0.15 μg/dl. Large amounts of both are bound to plasma proteins.

The plasma proteins that bind thyroid hormones are albumin, transthyretin, and thyroxine – binding globulin (TBG).

99.98% of T4 is plasma is protein bound. The free T4 level is about 2 ng/dl. The half life of T4 is 6-7 days (6).

99.8% of T3 is protein bound in plasma. The free T3 level is 0.3 ng/dl. It has a shorter half life than T4 (6).

The free thyroid hormones in plasma are in equilibrium with the protein bound thyroid hormones in plasma and in tissues.

It is the free thyroid hormones in plasma that are physiologically active. It is this fraction that inhibits pituitary secretion of TSH.

METABOLISM OF THYROID HORMONES

T4 and T3 are deiodinated in the liver, the kidneys and other tissues. One third of circulating T4 is normally converted to T3 and 45% is converted to RT3. In the liver, T4 & T3 are conjugated to form sulphonates and glucoronides. These conjugates enter the bile and pass into the intestine. The thyroid conjugates are hydrolysed, some are resorbed and some are exerted in the stool.

REGULATION OF THYROID SECRETION

Pituitary TSH is the primary hormone controlling the thyroid gland function. TRH is secreted by the hypothalamus. This in turn increases secretion of TSH. Circulating free T3 and T4 inhibit TSH by a negative feedback mechanism.

PATHOLOGY

Malignant thyroid neoplasms are classified as follows (16):

Primary epithelial tumors:

A) Tumours of follicular cells

Well differentiated

Papillary

Follicular

Poorly Differentiated

Insular

Others

Undifferentiated – Anaplalstic

B) Tumors of C cells

Medullary carcinoma

C) Tumors of follicular and C cells

Mixed medullary follicular carcinoma

Primary Non epithelial Tumors:

Malignant Lymphomas

Sarcomas

Others

Secondary Tumors, Metastatic

Thyroid Oncogenesis

The development of thyroid neoplasia includes two important processes: Mutated protooncogenes which result in altered protein production thus an acceleration in growth and alternations in tumor suppressor genes that cause unregulated cell growth (13).

Oncogene Activators

1. ras Gene Family – This gene family encodes signal transduction G proteins. Mutational activation of this oncogene causes production of inactive form of enzymes that degrade proteins. Thus continuous protein accumalation is allowed. 40% of thyroid tumors may have one of the three ras gene point mutations (H- ras, K-ras or N-ras). K-ras mutations are more frequent in radiation-induced papillary cancers. Patients in iodine sufficient areas have a higher incidence of ras mutations.

2. RET protooncogene – This encodes for a tyrosine kinase receptor on the cell membrane. It is involved in the differentiation of neuronal cells. Mutation of this gene is associated with the development of medullary carcinoma of thyroid, papillary carcinoma of thyroid and predilection of the cancer for distant metastasis. There is increased prevalence in patients who have had radiation exposure.

3. Tyrosine kinase Receptors – Activations of these receptors leads to a cascade of events which through phosphorylation activate multiple pathways with a variety of metabolic results. Three different tyrosine kinase receptor groups (RET, trk, met) have been implicated in the development of thyroid cancer.

Tumor suppressor Genes: p53

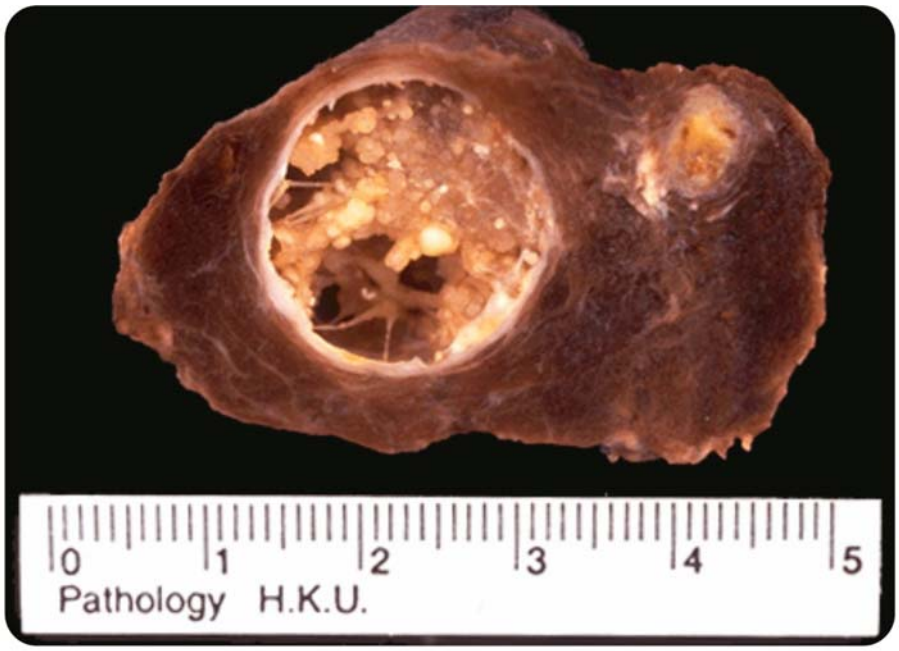
This gene encodes a phosphoprotein that inhibits several genes responsible for normal cell growth and differentiation. Mutations of p53 are found in the late stage of tumor growth and spread and in the more poorly differentiated anaplastic thyroid cancer.

Papillary Carcinoma

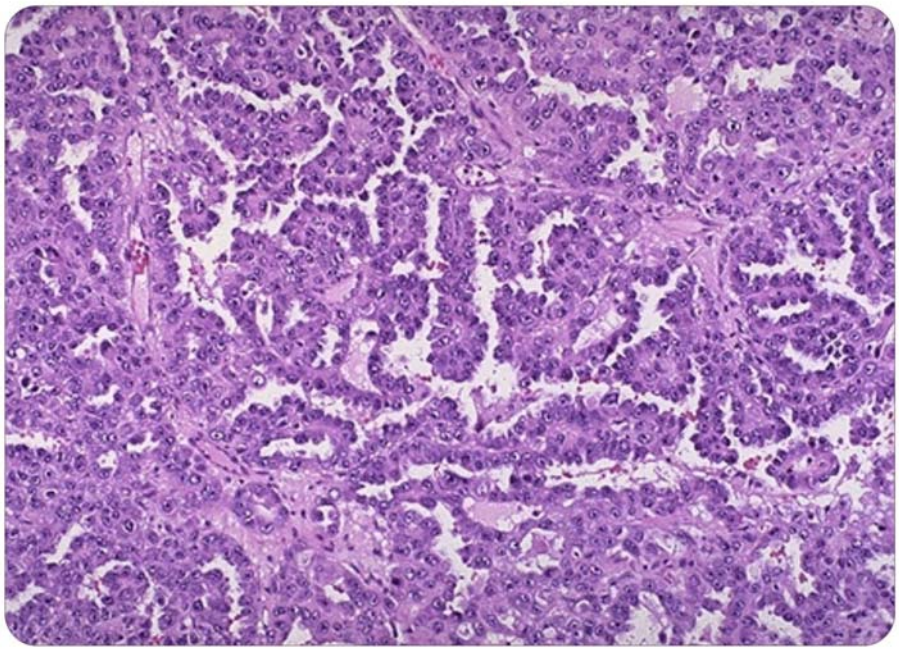
It is the most common thyroid malignancy. It accounts for 80-85% of all thyroid cancers (5). There is a 2:1 female preponderance in the incidence of papillary carcinoma. Mean age at presentation is 30-40 years (14).

Macroscopic Pathology

Papillary carcinomas may be solitary or multifocal lesions within the thyroid. Cystic change, calcification and ossification may be found in the tumor. Tumors may appear well circumscribed and capsulated or may infiltrate adjacent parenchyma. Microcarcinomas are papillary thyroid carcinomas smaller than 1 cm.



PAPILLARY CARCINOMA - GROSS SPECIMEN



PAPILLARY CARCINOMA - HISTOPATHOLOGY

Microscopic Pathology

Papillary carcinomas may have branching papillae with a fibro vascular stalk covered by epithelium. The cells are cuboidal with pale, abundant cytoplasm; crowded nuclei and intranuclear cytoplasmic inclusions. These are the 'Orphan Annie nuclei.' Nuclear pseudo inclusions and nuclear grooves are characteristic features. Concentrically calcified structures termed psammoma bodies may be present within the lesion.

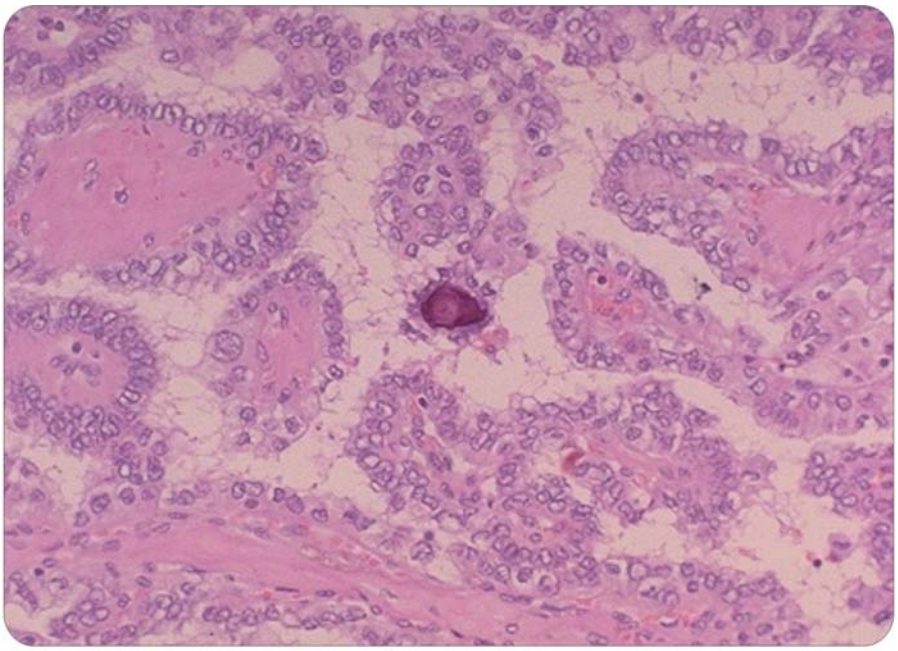
Histological variants of papillary carcinoma are: mixed papillary and follicular, follicular, tall cell, insular, columnar, diffuse sclerosing, clear cell, trabercular and poorly differentiated types (14).

Follicular Carcinoma:

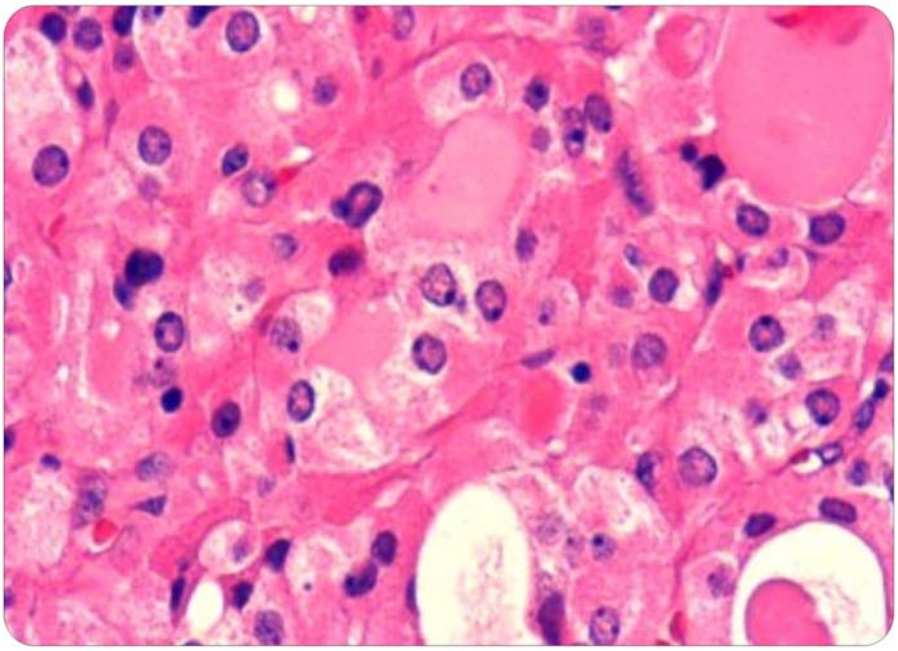
This constitutes 5-10% of all thyroid malignancies (5). Women have a higher incidence of this cancer, with female: male ratio of 3:1. Mean age of presentation is 50 years (14).

Macroscopic Pathology

These are single nodules that may be well circumscribed or infiltrative. Large lesions may penetrate capsule and infiltrate into the adjacent neck.



PSAMMOMA BODY IN PAPILLARY CARCINOMA



HURTHLE CELL CARCINOMA - HISTOPATHOLOGY

Microscopic Pathology

Follicular carcinoma can only be diagnosed in the presence of capsular, lymphatic or vascular invasion.

Using these criteria 2 types of follicular carcinoma are described (14)

a. Minimally invasive carcinoma where microscopic examination is required to demonstrate lymphavascular and capsular invasion and

b. widely invasive carcinoma where gross invasion is seen.

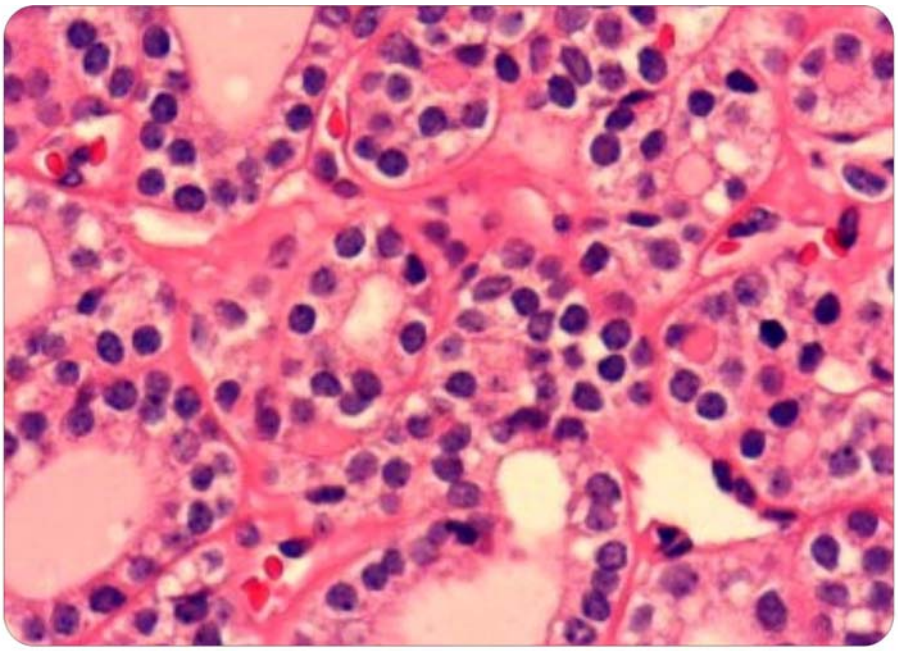
Follicular carcinoma cannot be diagnosed by an FNAC.

Hurthle cell carcinoma

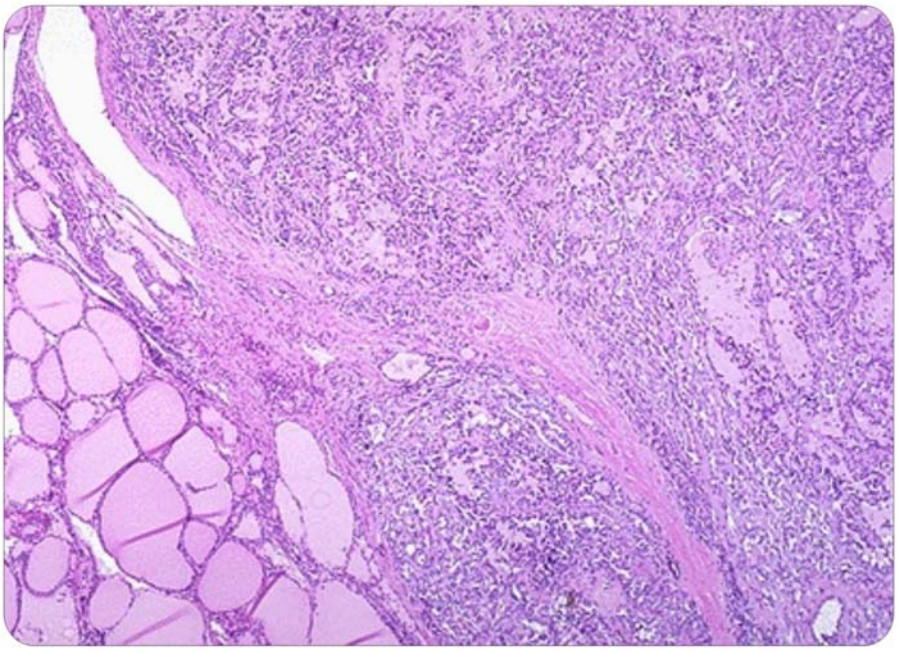
It accounts for 3% of the thyroid cancers (14). It is considered a subtype of follicular thyroid cancer. It cannot be diagnosed by FNAC. 30% of hurtle cell carcinomas are multifocal and bilateral. Only 5% of these tumors take up radioactive iodine. 20% of the tumors metastasise in 10 years (14).

Microscopic Pathology

The tumor cells arise from the oxyphillic cells of the thyroid. The tumors contain sheets of eosinophillic cells packed with mitochondria.



FOLLICULAR CARCINOMA - HISTOPATHOLOGY



MEDULLARY CARCINOMA - HISTOPATHOLOGY

Medullary Carcinoma

5% of all thyroid malignancies are medullary carcinomas of thyroid. They arise from the parafollicular or 'C' cells of thyroid.

Microscopic Pathology

They may arise as a solitary nodule which is commonly seen in the sporadic type or may be multicentric and bilateral which are common in familial cases.

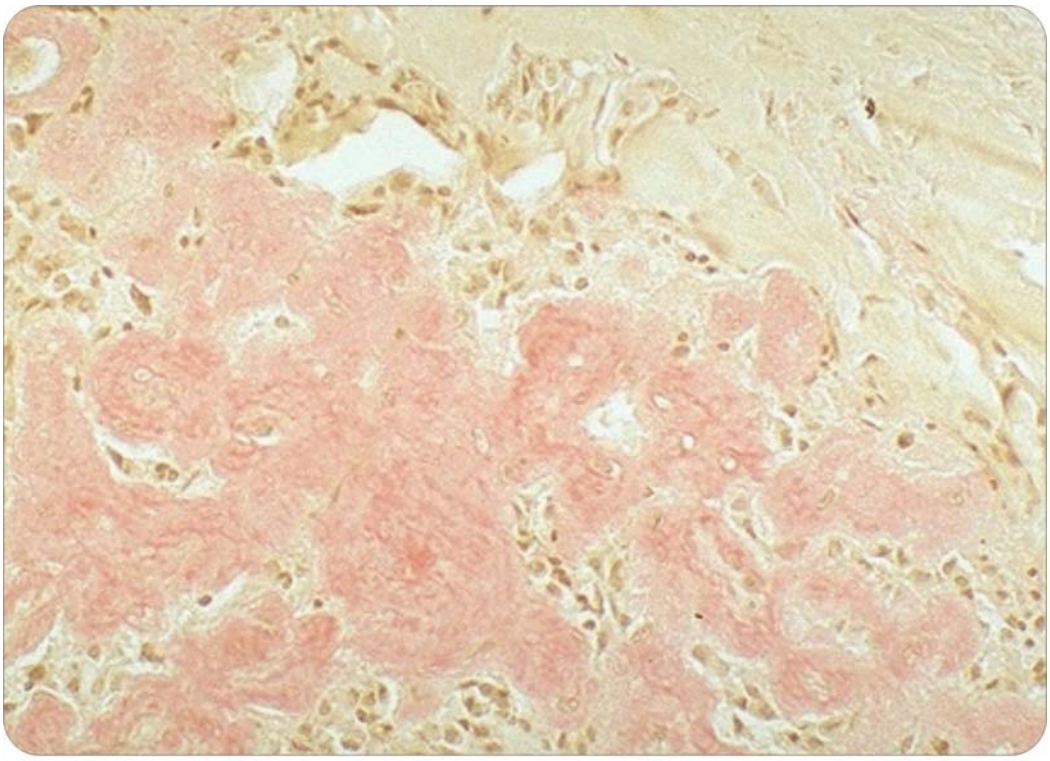
Microscopic Pathology

They are composed of polygonal to spindle shaped cells which may form nests, trabeculae and even follicles. Acellular amyloid deposits derived from altered calcitonin molecules are charactertic findings (17).

Various patterns seen are: glandular, solid, spindle cell, oncocytic, clear cell, papillary, small cell and giant cell (5).

Types of medullary carcinoma are (5)

1. Sporadic
2. Familial
3. MEN 2A



MEDULLARY CARCINOMA - CONGO RED STAIN

4. MEN 2A with cutaneous lichen amyloidosis

5. MEN 2A or familial medullary thyroid cancers with Hirshprung's disease

6. MEN 2B

These tumors secrete calcitonin, carcinoembryonic antigen (CEA), calcitonin gene-related peptide, histaminadases, prostaglandins E2 and F2 and serotonin.

Anaplastic carcinoma

It is the most aggressive of thyroid malignancies. This accounts for < 5% of all thyroid cancers. Women are more commonly affected. Most of the tumors present in the 7^{th} and 8^{th} decades of life. The mean age of presentation is 65 years.

Macroscopic Pathology

These tumors are firm and whitish in appearance.

Microscopic Pathology

Three histological patterns are seen (12):

1. Large, pleomorphic giant cells

2. Spindle cells with a sacromatous appearance

3. Small anaplastic cells resembling those seen in small cell carcinomas arising in other sites.

Lymphoma

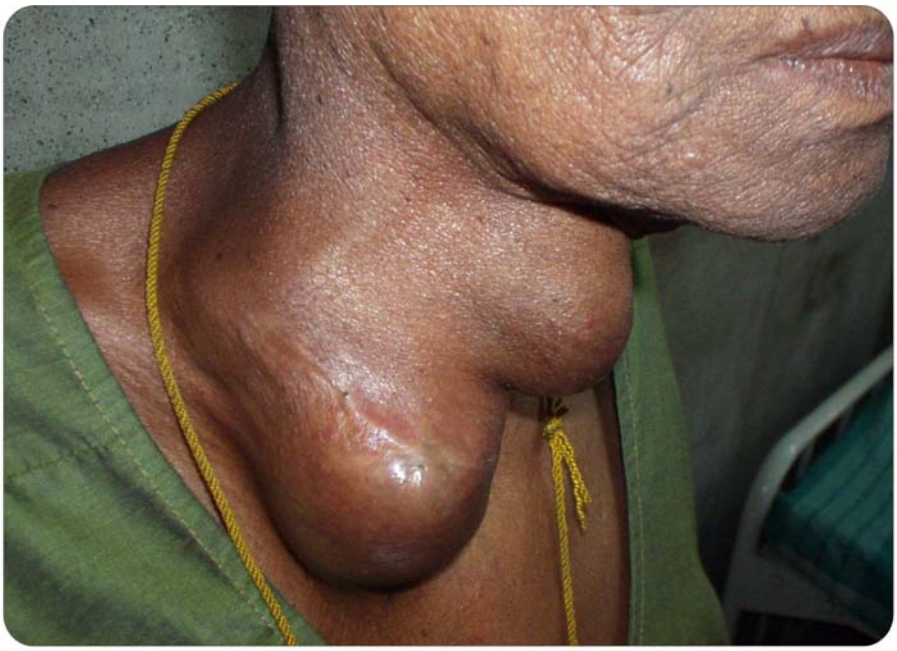
Lymphomas account for less than 1% of thyroid malignancies (15). They are mostly of the non-Hodgkin's B cell type. Most lymphomas develop in patients with Hashimoto's thyroiditis.

Metastatic Carcinoma

The thyroid gland is a rare site of metastasis. The primary tumors usually are from the kidney, breast, lung and melanoma.

EPIDEMIOLOGY

Thyroid cancer is the most common endocrine malignancy. It accounts for 91.2% of the total new endocrine cancers and 56.5% of deaths due to endocrine cancers in the year 2002 (5). The difference between the total number of cases of all endocrine cancers arising in the thyroid and total proportion of endocrine cancer deaths indicates that it is an indolent disease and is associated with long term survival.



PAPILLARY CARCINOMA

ANAPLASTIC CARCINOMA

Well differentiated cancer has a 2.5:1 female preponderance (4). The median age at diagnosis is earlier in women than men for both papillary and follicular cancer.

ETIOLOGY AND RISK FACTORS

1. Radiation

Low dose therapeutic radiation of about 6.5 cGy – 1500 cGy was used to treat conditions like tinea capitis, thymic enlargement, enlarged tonsils and adenoids, acne vulgaris, hemangioma and scrofula in the past. Radiation of about 4000 cGy is used to treat Hodgkin's disease. It is now known that exposure to low dose ionizing radiation to the thyroid gland causes increased risk of development of thyroid malignancy. Most of these are papillary carcinoma of thyroid. The risk is maximum 20-30 years after exposure, but patients require lifelong monitoring. Over 9000 cGy the risk declines as the gland is sterilized.

2. Iodine

Papillary carcinoma of thyroid may be common in areas with high iodine content in diet. Follicular neoplasia is seen in regions having high incidence of goiter (iodine deficient areas.)

3. Heredity

Medullary carcinoma is inherited in an autosomal dominant form in 20% of cases. Other conditions associated with thyroid cancers are Gardner's syndrome, Familial Polyposis and Cowden's syndrome.

Other risks factors are:

1. Hashimoto's thyroiditis

2. Familial forms of papillary and follicular carcinoma

Factors predisposing to thyroid cancer and types associated are:

TSH	-	Papillary
Low dose radiation	-	Papillary
Iodine deficiency	-	Follicular
Iodine abundance	-	Papillary
Genetic	-	Medullary
Thyroiditis	-	Lymphoma
Preexisting goiter / neoplasia	-	Anaplastic

THYROID DISPLACING TRACHEA

PAPILLARY CARCINOMA WITH NODAL SECONDARIES

Clinical Features (15)

Histological features that suggest malignancy are:

1. Young (<20 years) or old (>70 years) age

2. Male sex

3. A history of external neck radiation during childhood or adolescence

4. Recent changes in speaking, breathing or swallowing.

5. Family history of thyroid cancer or multiple endocrine neoplasia (MEN) type 2

6. Rapid expansion of an existing nodule

7. History of pain in a thyroid nodule

The findings on physical examination which may indicate malignancy are

1. Firm consistency of nodule

2. Irregular shape

3. Fixity to underlying or overlying tissues

4. Significant regional lymphadenopathy

5. Features of Horner's syndrome

6. Vocal cord paralysis seen on indirect laryngoscopy.

The above clinical features should increase the suspicion of a thyroid malignancy. Confirmation of the diagnosis requires investigations.

INVESTIGATIONS

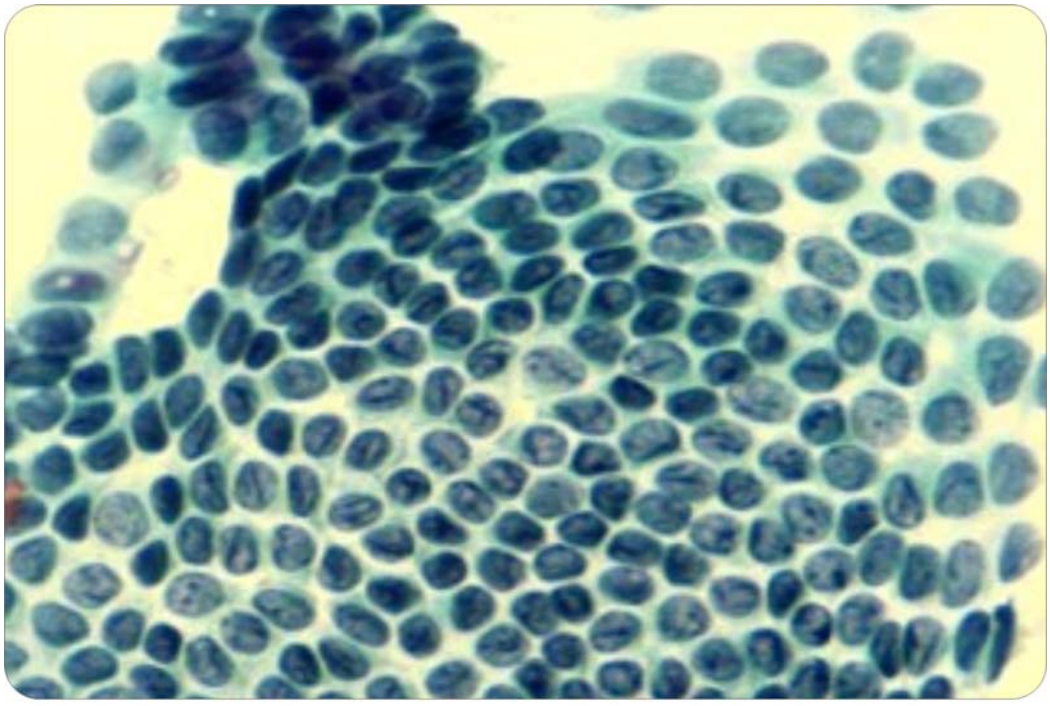
1. Fine Needle Aspiration Cytology (FNAC)

FNAC was popularized in the 1960s by Einhorn and Frazen at the Karolinsta Institute, Stockholm. It is an extremely sensitive and cost effective method of detecting thyroid malignancies. The accuracy of FNAC ranges from 70% to 97% (5).

A variety of molecular markers have been tried in FNAC specimens to improve the yield of malignancy. These include telomerase activity, presence of loss of hetero zygosity by polymerase chain reaction based microsatellite analysis, patterns of protein expression by immunocytochemical analysis.

False positive results for malignancy occur in 3-6% of FNAC specimens (5).

False negative results occur in 1-6% of cases (5).



PAPILLARY CARCINOMA - FNAC

The results of FNAC can be classified as follows (5):

Result	**:**	**Percentage of samples**
Benign	:	53-90%
Malignant	:	1-10%
Suspicious or indeterminate	:	5-23%
Insufficient sampling	:	15-20%

Advantages of FNAC

1. Preoperative diagnosis of malignancy is obtained which determines the type of surgery to be performed.

2. It reduces the number of patients with benign nodules subjected to diagnostic thyroid lobectomies

3. It is possible to diagnose lymphoma and anaplastic carcinoma by FNAC. Unnecessary surgery is avoided in these patients.

4. It has a high degree of sensitivity, specificity and accuracy at a low cost and can be done with minimum morbidity

5. A diagnosis of malignancy on FNAC will prompt immediate treatment for the patient.

Disadvantages of FNAC

1. Highly experienced pathologist is required for interpretation of the FNAC specimen.

2. The malignant potential of follicular neoplasms cannot be determined on FNAC as it requires the demonstration of capsular and vascular invasion.

3. It is less reliable in patients with history of head and neck irradiation or a family history of thyroid cancer because of higher likelihood of multifocal lesions

2. Ultrasound of the neck

This is used to distinguish solid from cystic nodules, for detecting non-palpable thyroid nodules, for identifying adjacent lymphadenopathy. It proves as a noninvasive and inexpensive method of following the size of benign nodules. USG guided FNAC can be done which may increase yield of FNAC as it enables the radiologist to take the sample from the solid areas of the nodule. Pure cystic lesions which are 4 cm in size or larger have a 7% chance of malignancy. Mixed solid and cystic lesions are malignant in 12% of cases while 21% of solid lesions are found at surgery to harbour malignancy (14).

CT NECK - THYROID CARCINOMA INFILTRATING THYROID CARTILAGE

THYROID CARCINOMA WITH MEDIASTINAL NODES

3. Core Needle Biopsy / Trucut Biopsy

The indications for this are:

1. Suspected anaplastic carcinoma of thyroid or lymphoma of thyroid

2. Inoperable lesions

4. Thyroid Scanning

The agents used for thyroid scanning are ^{123}I, ^{131}I and Technitium 99 m per technetate.

The thyroid scan can be used to differentiate between functioning and non functioning thyroid nodules. 15-20% of patients with cold nodules and < 5% of patients with hot or warm nodules have thyroid cancer (14). Thyroid scanning is currently recommended in the assessment of thyroid nodules only in patients who have follicular thyroid nodules on FNAC and a suppressed TSH (14).

5. CT scan & MRI

These are unnecessary for routine evaluation of thyroid tumors.

Indications for use are: large lesions, fixed lesions or substernal tumors. Invasion to adjacent organs can be diagnosed with these tests.

CT CHEST - MEDIASTINAL NODES IN THYROID CANCER

6. Blood Tests

a. Thyroid function tests (T3, T4, TSH): This is used to determine the functional status of the thyroid gland.

b. Thyroglobulin – It is used for monitoring patients with differentiated thyroid cancer for recurrence, especially after total thyroidectomy and radioactive iodine ablation.

It can be elevated in various benign diseases of the thyroid like thyroiditis, Grave's disease, toxic multinodular goiter

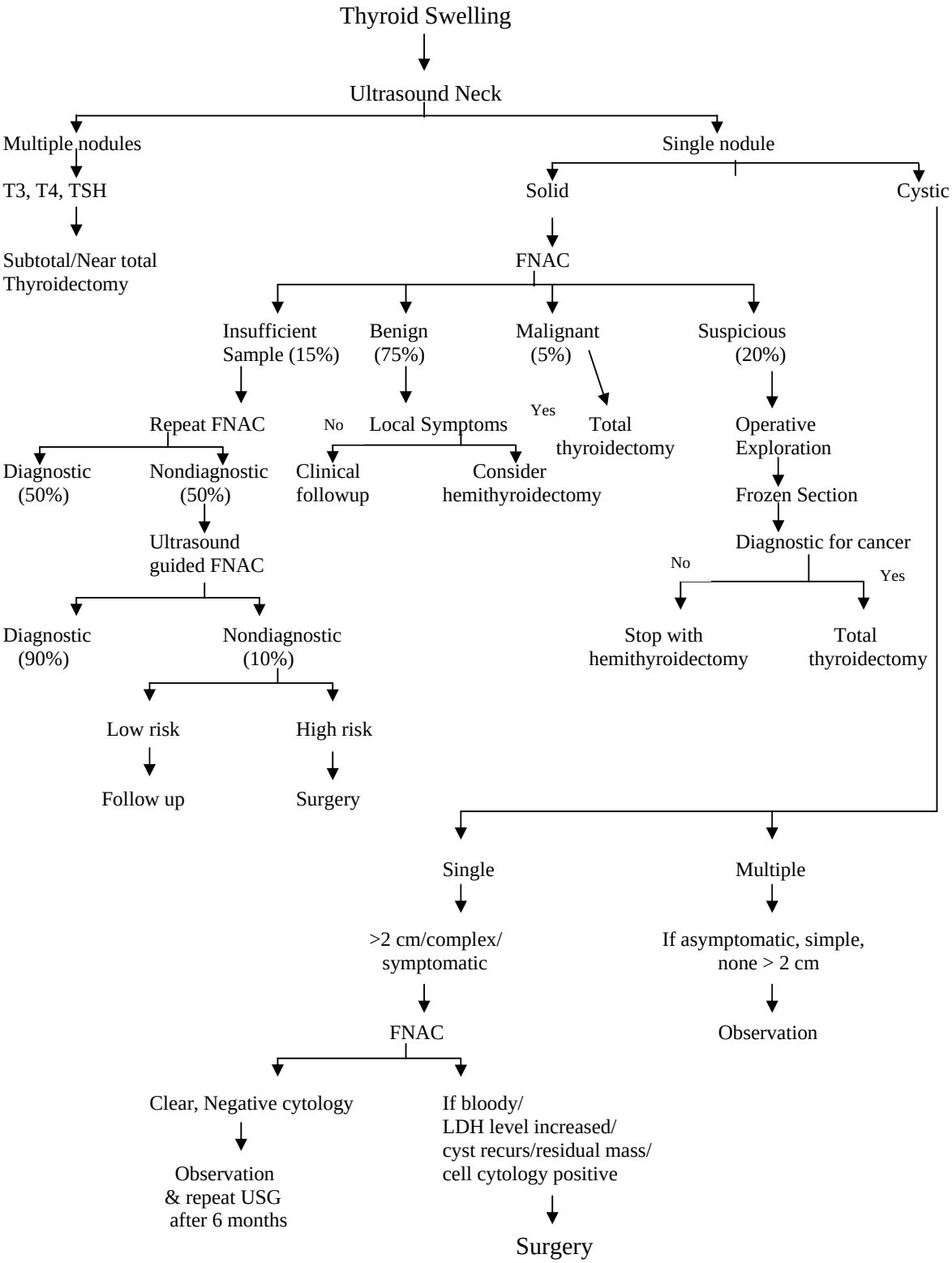
c. Serum calcitonin levels can be measured in medullary carcinoma thyroid

7. Position Emission Tomography (PET) Scan

18-FDG-PET Scan is used for localizing recurrent differentiated and poorly differentiated thyroid cancer especially if serum thyroglobulin is elevated and ^{131}I whole body scan is negative.

PET identifies the source of thyroglobulin production in 50-80% of patients.

Management of Nodular Goitre (16)



STAGING OF THYROID CANCER

There are many scoring and staging systems for thyroid cancers.

TNM clinical classification is the universally accepted system (5)

Tx - Primary tumor cannot be assessed

To - No evidence of primary tumor

T1 - Tumor $\leq$ 2 cm confined to the thyroid

T2 - Tumor > 2 cm and < 4 cm confined to the thyroid

T3 - Tumor > 4 cm confined to the thyroid or
Tumor of any size with minimal extrathyroid extension

T4a - Tumor of any size with extra thyroid extension to subcutaneous soft tissues, larynx, trachea, esophagus or recurrent larygreal nerve or Intra thyroidal anaplastic carcinoma

T4b - Tumor invading prevertebral fascia or encasing carotid artery or mediastinal vessels or Extrathyroidal anaplastic carcinoma

Regional lymph nodes (N) (Central compartment, lateral cervical and upper mediastinal)

Nx - Regional lymph nodes cannot be assessed

No - No regional lymph node metastasis

N1 - Regional lymph node metastasis

N1a - Metastasis to level VI (pretracheal, paratracheal and prelaryngeal) lymph nodes.

N1b - Metastasis to unilateral, bilateral or contralateral cervical or superior mediatinal lymph nodes

Distant Metastasis (M)

Mx - Distant metastasis cannot be assessed

Mo - No distant metastasis

M1 - Distant metastasis

Stage Groupings

Papillary and follicular carcinoma

Under 45 years of age

Stage I	Any T	Any N	Mo
Stage II	Any T	Any N	M1

45 years of age and over

Stage I	T1NoMo
Stage II	T2NoMo
Stage III	T3NoMo
Stage III	T1N1aMo
	T2N1aMo
	T3N1aMo
Stage IV	T4aNoMo
	T4aN1aMo
	T2N1bMo

	T3N1bMo
	T4aN1bMo
Stage IVB	T4b any N Mo
Stage IVC	anyT any N M1

Medullary Carcinoma

Stage I	T1No Mo
Stage II	T2No Mo
	T3No Mo
Stage III	T1No Mo
	T2N1aMo
	T3N1aMo
Stage IVA	T4aNoMo
	T4aN1aMo
	T1N1bMo
	T2N1bMo

T3N1bMo

T4aN1bMo

Stage IVB T4b any N Mo

Stage IVC any T any N M1

Anaplastic Carcinoma

Stage IVA T4a any N Mo

Stage IVB T4b any N Mo

Stage IVC any T any N M1

The other prognostic classification systems used for well differentiated thyroid cancers are described below (5):

AGES Scale: The criteria included are:

Age, Grade of tumor, Extent, Size of tumor

AMES Scale: The following factors are included here:

Age, Metastasis, Extent, Size of tumor

EORTC criteria: European organization for Research and treatment of cancer published the first prognostic scoring system for thyroid malignancies. It includes the following:

Age, Sex, Cell type, Extrathyroidal invasion, Metastases

DAMES Criteria are: DNA ploidy, Age, Metastases, Size.

MACIS SCALE: This takes into account the following factors:

Metastases, Age, Completeness of resection, Invasion, Size.

Ohio State Criteria – This includes the following:

Size, cervical metastases, multiplicity, invasion, distant metastases.

NTCTS Criteria (National Thyroid Cancer Treatment Cooperative Study) – The factors taken into account are: Size, multifocality, invasion, differentiation, cervical metastases, extracervical metastases.

Sloan – Kettering Criteria – These are:

Age, histology, size, extension, metastases.

Degroot and associates have classified thyroid cancers as follows to determine prognosis: class I (intrathyroidal) Class II (certival nodal) Class III (extrathyroidal invasion, Class IV (distant metastases).

These prognosic classification systems are used to divide patients with thyroid cancer into the low-risk and high-risk groups. Such a division makes it possible to counsel patients and help guide decision making about the intensity of postoperative tumor surveillance and management.

TREATMENT

A. Surgical Treatment of thyroid carcinoma

The goal of surgery is to remove all the malignant neoplastic tissue in the neck. The extent of surgery appropriate for thyroid malignancy depends on the histologic diagnosis, the size of the original lesion, the presence of distant metastasis, the patient's age and the risk group category.

The advantages of total thyroidectomy for well differentiated thyroid carcinoma are (5):

1. Higher survival rate for lesions > 1.5 cm in diameter
2. Lowest recurrence rate in all patients
3. Prevention of recurrence in the contralateral lobe
4. Reduction of the risk of developing pulmonary metastasis
5. Can be performed with the same morbidity and mortality as hemithyroidectomy

6. Improved sensitivity of serum thyroglobulin as a marker for persistent or recurrent disease

7. Radioactive iodine can be used to detect and treat persistent or recurrent disease

8. Reduces possibility of residual tumor in contralateral lobe undergoing transformation to anaplastic carcinoma

MANAGEMENT OF THE PRIMARY TUMOR

Papillary Carcinoma

When patients are found to have micro papillary thyroid carcinoma in a specimen removed for other reasons, unilateral hemi thyroidectomy is sufficient as long as there is no extra thyroidal invasion.

In all other cases, total or near total thyroidecomy is the procedure of choice.

Follicular Carcinoma

Patients who have FNAC diagnosis of follicular neoplasm should undergo a hemithyroidectomy and the specimen is to be sent for frozen section.

For extremely low risk patients ie < 2 cm lesion with only capsular invasion ipsilateral hemithyroidectomy may be sufficient (16). For all other cases, total thyroidectomy should be performed.

Hurthle Cell Carcinoma

Total thyroidectomy with central compartment dissection is the procedure of choice for these patients

Medullary Carcinoma

The recommended surgery for medullary carcinoma is total thyroidectomy with central compartment dissection. Pheochromecytoma should be operated on first if present.

Anaplastic Carcinoma

Prognosis for this cancer is very poor. If the carcinoma presents as a resectable mass, total thyroidectomy may lead to a small improvement in survival especially in younger patients. For patients with impending airway obstruction, isthmectomy should be done. In the presence of an airway obstruction – tracheostomy may be the treatment of choice. The surgical treatment is followed by a combination of external irradiation and chemotherapy.

MANAGEMENT OF NECK NODES

In the presence of palpable metastatic cervical lymph nodes – Ipsilateral modified radical neck dissection type III (functional neck dissection) is the treatment of choice for differentiated thyroid cancers and medullary carcinoma.

Prophylactic central compartment nodal dissection is done for hurtle cell carciroma and medullary carcinoma.

The presence of metastatic disease to lymph nodes does not alter the prognosis for thyroid cancers.

MANAGEMENT OF LOCALLY ADVANCED THYROID CARCINOMA

Patients with extra thyroidal extension require en-bloc resection of the invaded structures.

If tumor is on the anterior thyroid – resection of overlying strap muscles is done. This causes minimal morbidity.

If tumor is posterior – the margins of resection are either the trachea or esophagus. For well differentiated thyroid cancers, tracheal or esophageal resections are not indicated. If gross involvement of trachea or esophagus is present, resection with reconstruction is the appropriate procedure. (5)

B. POSTOPERATIVE MANAGEMENT

1. Iodine 131 Therapy (Radioiodine Therapy)

Indications for post operative radioiodine therapy are

1. All papillary and follicular carcinomas larger than 1.0 to 1.5 cm

2. Locally invasive well differentiation thyroid cancers

Postoperative radioiodine therapy reduces recurrence, development of distant metastases and causes a improvement in survival (5). Metastatic differentiated thyroid carcinoma can be detected and treated by ^{131}I in 75% patients.

T4 therapy should be discontinued for approximately 6 weeks before ^{131}I scanning. Patients should receive T3 during this time to decrease the period of hypothyroidism – it is discontinued for 2 weeks to allow TSH levels to rise prior to treatment. Low iodine diet is recommended during this 2 week period.

Doses for treatment of metastic disease are as follows:

Screening Dose : 2 mCi of ^{131}I

Therapeutic Dose : 30-100 mCi in low risk patient

100-200 mCi in high risk patient

2. Thyroid Hormone

The growth of thyroid tumor cells is controlled by TSH and inhibition of TSH secretion with levothyroxine decreases recurrence and improves survival rates. All patients with well differentiated thyroid cancer should take thyroxine postoperatively.

Thyroxine should be administered to ensure that the patient remains enthyroid with circulating TSH levels at about 0.1 μU/L in low risk patients or less than 0.1 μU/L in high risk patients (14).

In patients with anaplastic thyroid carcinoma, medullary carcinoma or thyroid lymphoma replacement dose of levothyroxine is given with the aim of obtaining a serum TSH level in the normal range.

3. Thyroglobulin Measurement

Thyroglobulin levels should be below 2 ng/ml when patient is taking thyroxine and below 5 ng/ml when patient is not taking thyroxine (14). A high thyroglobulin level is highly suggestive of metastatic disease or persistent normal thyroid tissue.

4. External Beam radiotherapy

1. It is used to control unresectable, locally invasive or recurrent disease.

2. It is used to treat metastasis in support bones to decrease the risk of fractures.

3. It can be used for treatment and control of pain from bony metastases when there is minimal or no radio iodine uptake.

5. Chemotherapy

Indications for chemotherapy are: inoperable and ^{131}I resistant tumors Adriamycin and Taxol are the most frequently used agents.

OUTCOME PREDICTION

The overall 10 year survival for patients with well differentiated papillary thyroid carcinoma ranges between 74% and 93% (5). Patients with follicular cancer have a 10 year survival of 43% to 94% (5).

For patients with anaplastic thyroid carcinoma, the median survival is 3 to 4 months from the time of diagnosis (5).

The 10 year survival for patients with medullary thyroid cancer is 70-80% (4).

RECENT LITERATURE

Predicting Outcome and directing therapy for papillary thyroid carcinoma (10). Kim S et al., concluded in this study that papillary thyroid carcinomas in low risk patients had a favourable prognosis regardless of treatment. Older high risk patients had a survival benefit with total thyroidectomy and lymph node dissection. Radioactive iodine did not affect 20 year survival in any of the risk groups.

Predictive factors in mortality and morbidity in patients with differentiated thyroid cancer. The conclusions drawn from this study were. The mortality rate is high for those who are 45 years and older. Patients with tumor size less than 4 cm had significantly lower mortality and recurrence. Other significant risk factors for death were male sex and follicular thyroid cancer (as opposed to papillary thyroid cancer).

Haigh PI et al., (8) in their study showed that the extent of thyroidectomy is not a major determinant of survival in low or high risk papillary thyroid cancer.

Another study by Bilimoria KY et al., (4) however, demonstrated that total thyroidectomy results in lower recurrence rate and improved survival for papillary thyroid cancer ≥ 1 cm compared with lobectomy.

Thus controversy still exists over the extent of surgery for differentiated thyroid cancers.

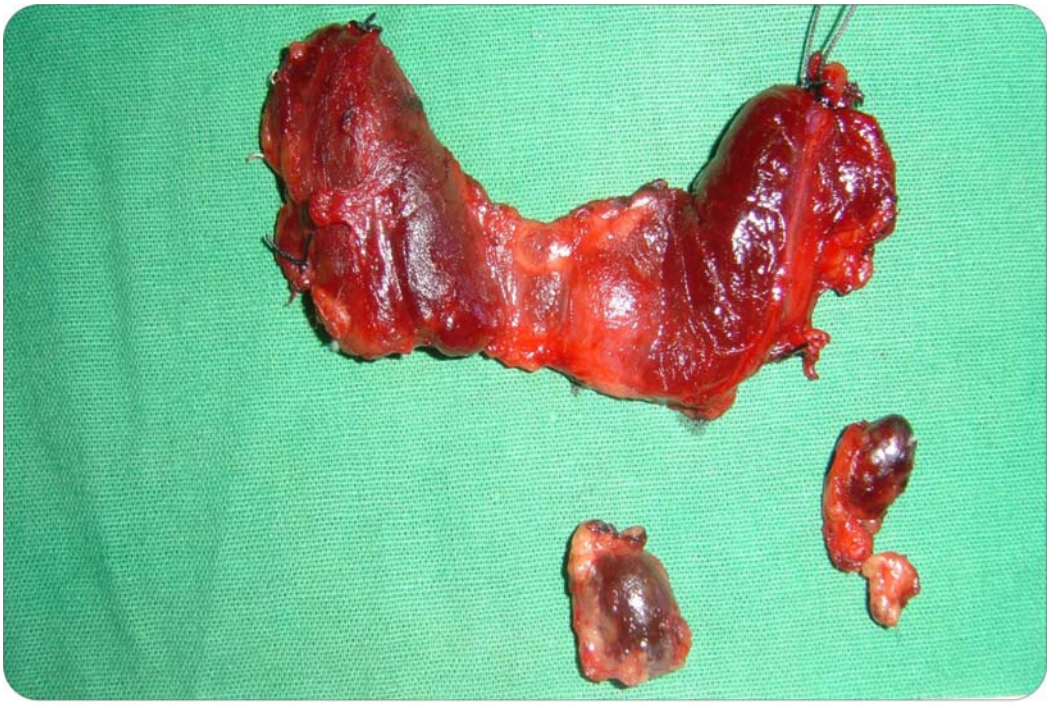
rhTSH – aided radioiodine ablation and treatment of differentiated thyroid carcinoma (11): Luster M et al found that rh TSH aided treatment may be preferred in patients who are at greater risk of hypothyroid complications from withdrawal of thyroid hormone or are unable to produce sufficient endogenous TSH.

Shaha AR et al (15) have made the following observations and recommendations for management of thyroid cancer. The incidence of thyroid cancer is rapidly increasing. A large number of incidentalomas are found during routine head and neck evaluations. The diagnostic workup revolves around fine needle aspiration biopsy. Ultrasound guided fine needle aspiration biopsy is likely to yield the best results. Surgical resection offers the best treatment choice. Controversy continues in relation to total versus less than total thyroidectomy. The incidence of complications is inversely proportional to the extent of surgery. The decision regarding the extent of thyroidectomy should be based on prognostic factors and risk groups. Prognostic factors are age, grade of tumor, extrathyroidal extension, size, distant metastasis and histology. Nodal metastasis does not alter prognosis. Based on these prognostic factors, thyroid cancers can be divided into low, intermediate and high risk groups. In the high risk group and in selected intermediate risk patients, radioactive iodine dosimetry and ablation should be considered after

total thyroidectomy. PET scanning and the use of recombinant TSH have been major advances in follow up care for patients with thyroid cancer. Thyroglobulin appears to be a very good tumor marker for follow up. No major breakthrough is noted in the management of anaplastic thyroid cancer. Identification of RET mutation has been extremely helpful in evaluating the family members of the patient with medullary thyroid cancer with strong consideration given to total thyroidectomy.

Clinicopathological characteristics and longterm outcome in patients with distant metastasis from differentiated thyroid cancer (3): Benbassat. CA et al., concluded from their study that complete resection of the thyroid gland at diagnosis and high dose adjuvant radioactive iodine are associated with improved survival in patients with metastatic DTC.

Role of radioactive iodine for adjuvant therapy and treatment of metastases (9). The article by Jonklass J. showed that radioiodine administration is a unique and powerful means of treating differentiated thyroid cancer because of the ability of thyroid cancer cells to concentrate beta emitting radiolabeled iodine. Several manipulations such as iodine depletion and thyroid hormone stimulating hormone elevation are used to enhance uptake of radiolabeled iodine by tumor cells. When radioactive iodine therapy is used in patients with residual or metastatic disease it clearly improves outcomes. It decreases recurrence and morality rates in thyroid cancer patients.



THYROIDECTOMY SPECIMEN

TECHNIQUE OF TOTAL THYROIDECTOMY

Preoperative preparation

The main aim of preoperative preparation is to make the patient euthyroid at operation

Anesthesia

General anesthesia with nitrous oxide and oxygen is usually preferred.

Position

The neck of the patient is extended by placing a pillow below the shoulders.

Technique (2)

Incision: A curved incision is made about 2 finger breaths above the suprasternal notch extending from the lateral border of one sternomastoid muscle to the corresponding point on the other sternomastoid muscle. Skin and superficial fascia are incised. The playsma is divided at a slightly higher level to produce a fine scar. The upper flap containing skin, subcutaneous tissue and platysma is reflected upwards to the level of the thyroid cartilage. The lower flap is reflected downwards to the sternum. The anterior jugular veins may require division between ligatures.

Exposure of the goiter

The investing layer of the deep fascia is incised vertically in the midline. The infrahyoid muscles are retracted. The veins, which come in the way are divided between ligatures. The anterior surface of the gland covered by pretracheal fascia is exposed. This fascia is incised and a finger is insinuated to know the whole extent of the thyroid. If retraction of the infrahyoid muscles does not provide adequate exposure of the gland the infrahyoid strap muscles can be divided as high as possible to avoid damage to the Ansa cervicalis.

Ligature of pedicles

The lateral surface of the thyroid lobe is cleared by finger dissection. The upper pole of the gland is delivered into the wound. The superior thyroid vessels will be seen forming the vascular pedicle. These vessels are clamped, cut and ligated as close to the gland as possible to avoid injury to the external laryngeal nerve. The middle thyroid vein is the identified by retracting the lateral lobe forward. This vein is ligated and divided. This step may be done before ligation of the superior pole. The recurrent laryngeal nerve is identified all along its course. The inferior thyroid artery is then identified and ligated in continuity taking care not to damage the nerve. The same procedure is performed on the opposite side.

Resection of the goitre

The thyroid gland is mobilized off the trachea by applying serial hemostats to the capsule of the lobe on its posterolateral aspect. The lobe is then sectioned from lateral to medial side, in a plane towards the front of the trachea. The wound is closed in layers. A suction drain may be kept for a period of 24-48 hours.

MATERIALS AND METHODS

This is a combined retrospective and prospective study of all patients with thyroid cancers admitted in the Departments of General Surgery and Surgical Oncology at the Government Kilpauk Medical College and Hospital and the Government Royapettah Hospital from January, 2005 to July, 2007. Patients who had thyroid carcinoma on histopathologic examination were included in the study.

All the patients with thyroid disease underwent a detailed clinical examination and indirect laryngoscopy (done by E.N.T. Surgeons) for evaluation of vocal cord status. All patients with an obvious thyroid swelling were subjected to an ultrasound of the neck and a Fine Needle Aspiration Cytology (FNAC). Patients who were symptomatic or had a positive or indeterminate FNAC were subjected to surgery. After surgery, all patients with differentiated thyroid cancers received suppressive dose of thyroxine. The patients were then followed up regularly after discharge or till the time of death.

The relevant information was tabulated and used for analysis. The observations were compared with the current literature on thyroid cancers and conclusions were drawn.

OBSERVATIONS AND DISCUSSION

All patients with thyroid cancer proven by histopathology admitted between January, 2005 and July, 2007 were included in the study. The study group consisted of 72 patients. A proforma was used to record the pertinent information about each patient. This was summarized into a master chart. The statistical inferences drawn are presented below.

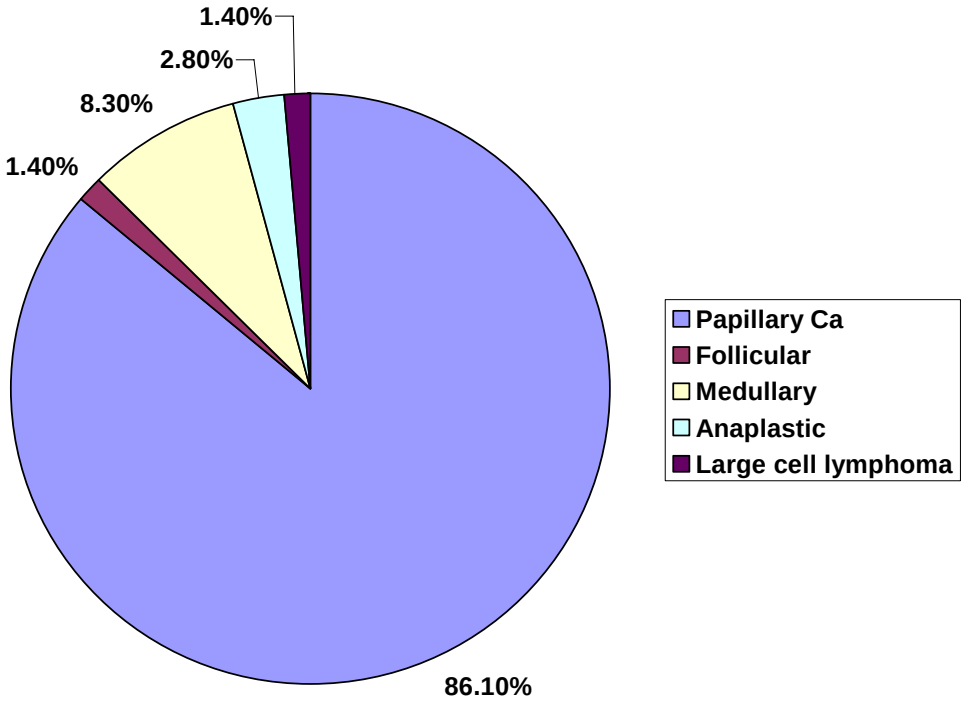
1. Prevalence of the different types of Thyroid Cancer

The prevalence of the different types of thyroid cancers in the study group is as follows:

Table - 1

Type of Thyroid Cancer	No. of Cases	% of Total
Papillary	62	86.1
Follicular	1	1.4
Medullary	6	8.3
Anaplastic	2	28
Large cell lymphoma	1	1.4
Total	72	100

Diagram - 1



Papillary Carcinoma (86.1%) is found to be the commonest type of thyroid cancer followed by medullary carcinoma of thyroid (8.3%)

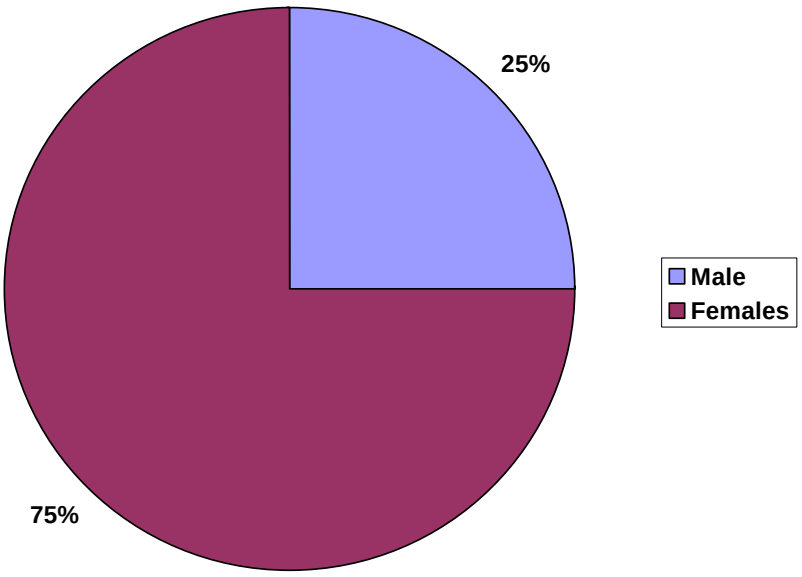
2. Sex Distribution

The sex distribution of thyroid cancers is tabulated below

Table - 2

Sex	No. of Cases	% of Total
Males	18	25
Females	54	75
Total	72	100

Diagram - 2



There is a female preponderance seen in thyroid cancers

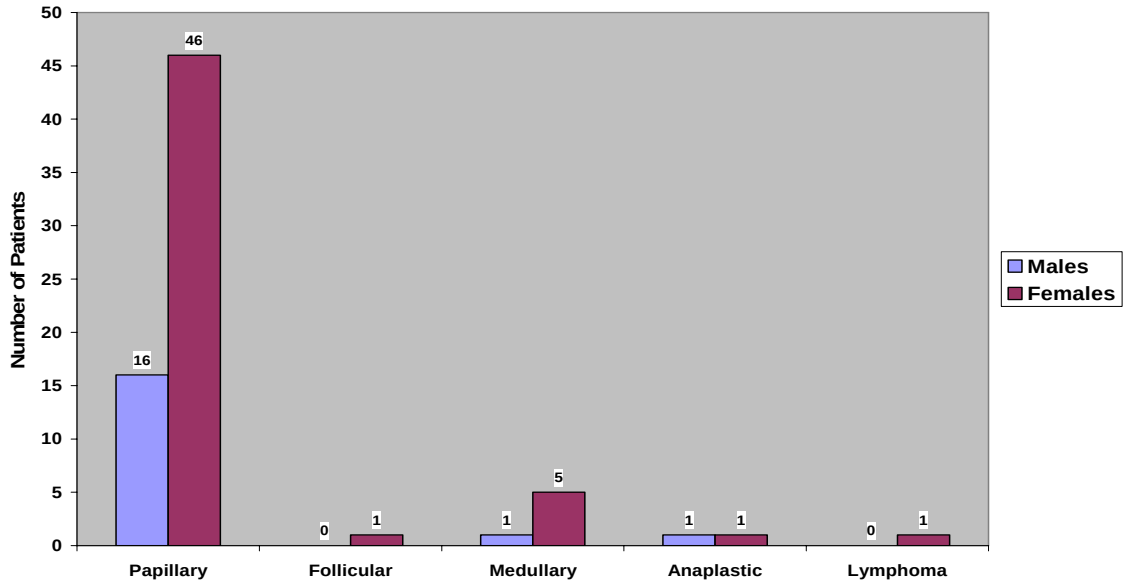
The male: female ratio is 1:3

Table - 3

The sex incidence in different types of thyroid cancers is as follows:

Type of thyroid cancer	Males		Females		Total No. of cases
	Number of cases	Percentage	Number of cases	Percentage	
Papillary	16	25.8	46	74.2	62
Follicular	-	-	1	100	1
Medullary	1	16.67	5	83.33	6
Anaplastic	1	50	1	50	2
Large cell lymphoma	-	-	1	100	1
Total	18		54		72

Diagram - 3



Papillary carcinoma is the commonest type of thyroid cancer seen in teeth males and females

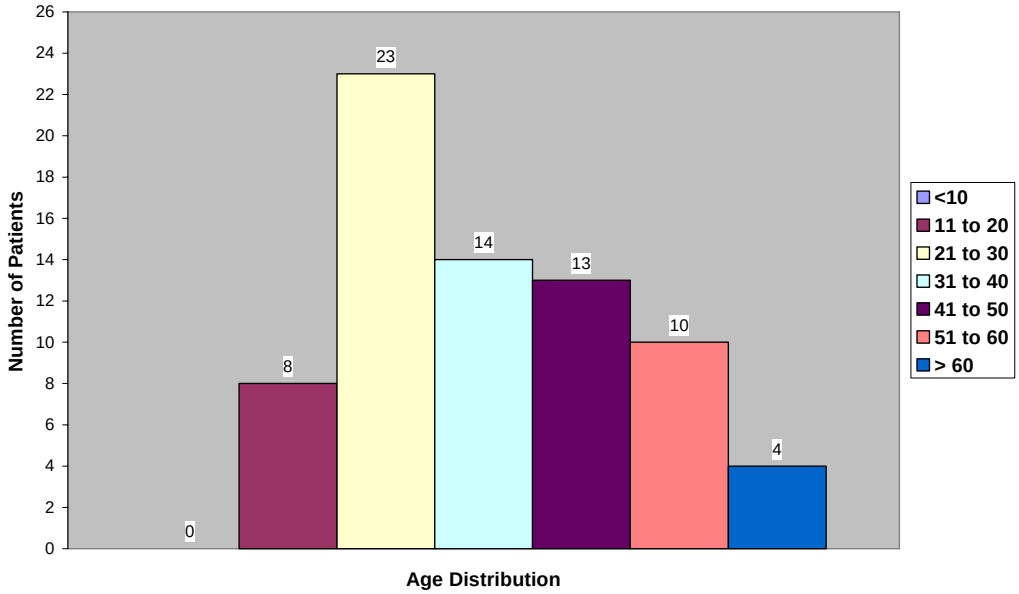
3. Age Distribution

The age distribution of thyroid cancers is as documented below

Table - 4

Age in years	Males	Females	Total
<10	-	-	-
11-20	1	7	8
21-30	4	19	23
31-40	1	13	14
41-50	7	6	13
51-60	3	7	10
>60	2	2	4
	18	54	72

Diagram - 4



The peak incidence of thyroid cancers is between 21-30 years of age.

The peak incidence of thyroid malignancies in males is between 41-50 years of age and in females is between 21-30 years of age. The average age of presentation of thyroid cancer is 38.3 years.

The average age of incidence of thyroid cancers in males and females is as follows

Table - 5

Sex	Average Age of Incidence
Males	44 yrs
Females	36.7 yrs

4. Distribution of patients according to age and peak incidence for the different types of thyroid cancers is as follows

Table - 6

Type of cancer	Age Range (in years)	Average age of incidence (in years)	Peak incidence (in years)
Papillary	13-78	36.5	21-30
Follicular	55	55	51-60
Medullary	27-60	41.5	31-40
Anaplastic	60-65	62.5	≥60
Large cell lymphoma	55	55	51-60

Papillary & Medullary carcinomas are seen in the younger age group than the other types of thyroid cancers

5. Symptomatology

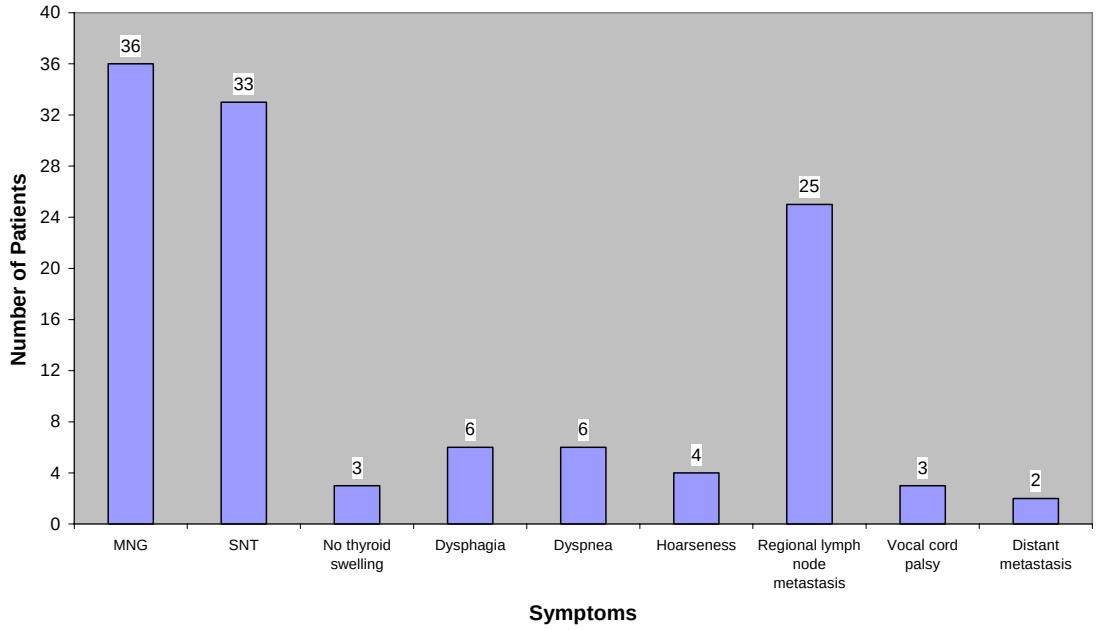
69 cases out of the 72 cases in the study group presented with thyroid swelling. Regional lymph node metastasis was seen in 25 patients and distant metastasis in 2 patients. 1 patient had an occult papillary carcinoma (with no thyroid swelling). 2 patients with papillary carcinoma who had undergone thyroidectomy previously presented during the study period with cervical nodal metastasis.

The findings noted are tabulated below:

Table - 7

Symptoms	Papillary	Follicular	Medullary	Anaplastic	Large cell lymphoma	Total	Percentage
Thyroid swelling							
MNG	31	-	2	2	1	36	50
SNT	28	1	4	-	-	33	38.9
Absent	3	-	-	-	-	3	4.2
Dysphagia	2	2	-	2	-	6	8.3
Dyspnea	4	-	-	2	-	6	8.3
Hoarseness	2	-	-	2	-	4	5.5
Regional lymph node metastasis	24	-	1	-	-	25	34.7
Vocal cord palsy	1	-	-	2	-	3	4.2
Distant metastasis	1	-	-	1	-	2	2.8

Diagram - 5



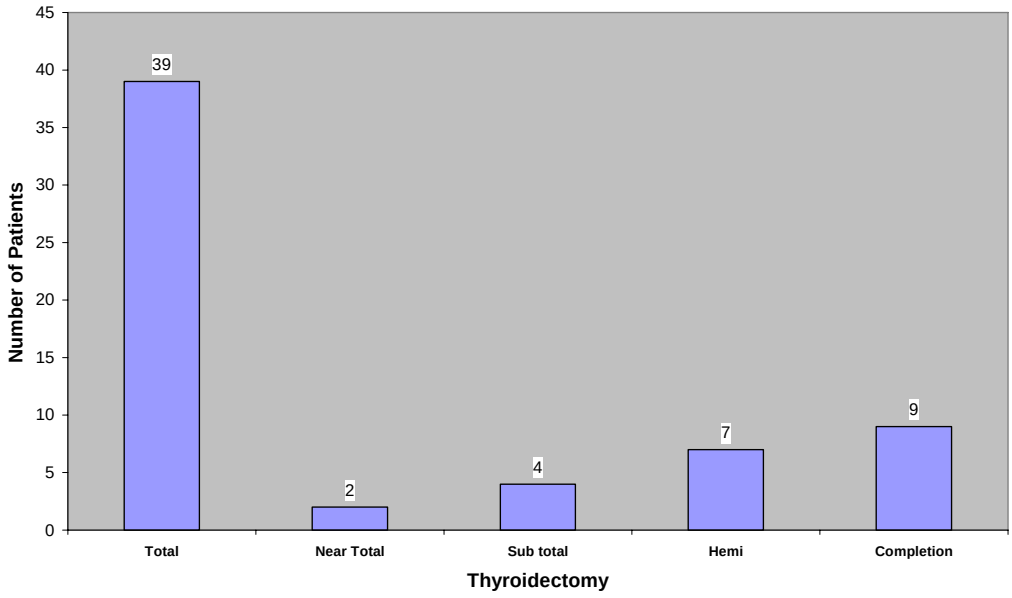
6. Treatment of Thyroid Malignancy

The commonest surgery done for the primary cancer is total thyroidectomy. 22 out of 25 (88%) patients with palpable cervical nodes were subjected to Modified radical neck dissection on the involved side (ie the side with palpable nodes). Bilateral paratracheal dissection was also done in all these cases. 17 patients out of the 47 patients (36%) without regional lymph nodes underwent a bilateral paratracheal dissection. 3 patients underwent trucut biopsy for histopathological confirmation of diagnosis and were treated by non surgical modalities - the patient with papillary carcinoma was treated with external beam radiotherapy. The patients with undifferentiated cancer and lymphoma were treated with radiotherapy and chemotherapy. The observations are as tabulated below:

Table - 8

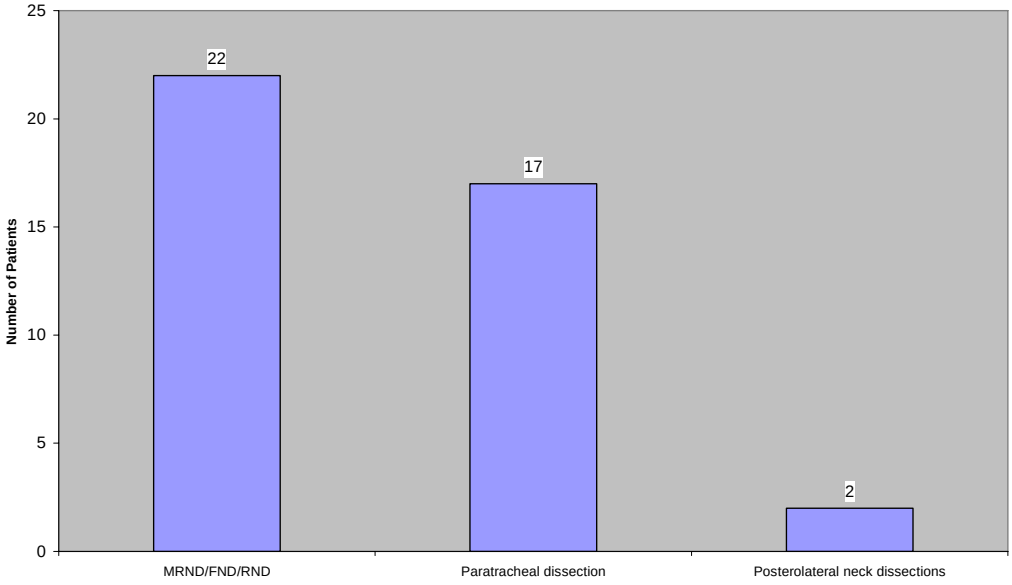
Types of surgery	Papillary	Follicular	Medullary	Anaplastic	Large cell lymphoma
Thyroidectomy					
Total thyroidectomy	39		1	1	
Near total thyroidectomy	2				
Subtotal thyroidectomy	4		1		
Hemithyroidectomy	7		2		
Completion thyroidectomy	9	1	2		
Neck Dissection					
MRND / RND / FND	22				
Paratracheal dissection	17				
Posterolateral neck dissection	2				
Trucut Biopsy	1			1	1

Diagram - 6



Distribution of patients undergoing thyroidectomies

Diagram - 7



Distribution of patients undergoing Neck dissections

All patients with differentiated thyroid cancers were followed postoperatively with suppressive doses of thyroxine. The other patients were given replacement doses of thyroxine.

7. Outcomes of thyroid cancer in the study group

Life expectancy following surgery could not be determined because of the short duration of the study. 2 patients died during the follow up period-both with anaplastic carcinoma.

CONCLUSION

1. Incidence of various types of thyroid cancers correlates approximately with the world literature except for follicular carcinoma which has a lower incidence in the study group.

Type of carcinoma	% In the study group	World literature (%)
Papillary	86.1	80-85
Follicular	1.4	5-10
Medullary	8.3	< 10
Anaplastic	2.8	5
Lymphoma	1.4	< 2

Papillary carcinoma of thyroid is the commonest thyroid malignancy in the study group. This correlates with the world literature (5). The incidence of follicular carcinoma is lower than the world literature.

2. Male: Female ratio in the study group is 1:3. This is comparable to the world literature where male: female ratio is 1:2.5 (5)

3. In the study group, median age at diagnosis for females is 30 years and for males is 44 years. This is comparable to the known literature where

median age at diagnosis is earlier in females than in males for both papillary and follicular subtypes (5).

4. Usually 2/3 rd (67%) of patients with differentiated thyroid carcinoma have disease localized to thyroid at presentation (5). In the study group, 60.3% patients have disease localized to the thyroid.

5. According to known data, 33-61% of patients with papillary thyroid cancer have metastatic cervical lymphadenopathy at diagnosis (5). In this study group, 38.7% patients (ie 24 patients out of 62) with papillary thyroid cancers had metastatic cervical lymph nodes at presentation.

6. 1-2% of patients with papillary thyroid cancer have distant metastasis at diagnosis (5). In the study group 1.6% of patients (ie 1 patient out of 64 patients) had distant metastasis. This is associated with a very poor prognosis.

7. The most common symptom at presentation for all thyroid cancers is a thyroid swelling. 26.3% of patients presented with symptoms of locally advanced disease.

8. Total thyroidectomy is now advocated for all well differentiated thyroid cancers and medullary thyroid cancer. Central compartmental dissection is to be done for all medullary thyroid cancers. Modified Radical Neck dissection is recommended only in the presence of metastatic cervical

lymph nodes. In the study group, total thyroidectomy was the commonest surgery performed. 22 out of 25 patients (88%) with palpable cervical lymph node underwent modified radical neck dissection on the involved side.

9. A combination of radiotherapy and chemotherapy (with adriamycin) is the most appropriate therapy for non resectable undifferentiated carcinomas (5). In the study group, one patient with anaplastic carcinoma underwent a total thyroidectomy supplemented with postoperative radiotherapy and chemotherapy. The other patient was treated with radiotherapy and chemotherapy alone.

10. TSH suppressive doses of levothyroxine is recommended for all patients with papillary and follicular thyroid cancers. This was followed for all patients in the study group with differentiated thyroid cancers. The goal of this therapy is serum TSH concentration of 0.1 mU/L or less.

11. Life expectancy of patients following surgery could not be ascertained due to the short duration of the study. 2 patients died during the follow up period – both were diagnosed to have anaplastic carcinoma of thyroid.

PROFORMA

Name: Age: Sex:

Inpatient No.: Ward:

I PRESENTING FEATURES

1. Swelling : Side
Duration
Progress
Any sudden change in size

2. Pressure effects : Dysphagia
Dyspnoea

3. Pain

4. Hoarseness of Voice

5. Toxic symptoms

6. Loss of Weight

7. Hypo or Hyper Thyroid Symptoms

8. Any other neck Swelling

II. H/O PREVIOUS SURGERY / IRRADIATION

III. MENSTRUAL AND OBSTETRIC HISTORY

IV FAMILY H/O. DEATH FROM THYROID MALIGNANCY

Pheochromocytoma

Diabetes

Hypertension

Tuberculosis

V. GEN. EXAMINATION:

Pulse

BP

Anaemia

VI. EXAMINATION OF LUMP

1. Site
2. Size
3. Shape
4. Surface
5. Extent
6. Margins
7. Skin over the swelling
8. Consistency
9. Movement with Deglutition
10. Intrinsic Mobility
11. Fixity
12. Tracheal Position
13. Carotids
14. Mediastinal Extension
15. Auscultation for Bruit
16. Neck Nodes
17. Bone

VII. EXAM OF OTHER SYSTEMS

VIII.	Laboratory	Post operative complication
	Chest X-Ray	Hemorrhage
	X-Ray Neck	Hypoclacemia
	IDL	Rec. Laryngeal Nerve Palsy
	Thyroid scan	Respiratory Obstruction
	FNAC	Follow up
	USG	After every 3 months

Treatment

Surgery

Node Dissection

Radiotherapy

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MASTER CHART

S.No.	Name	Age	Sex	IP No.	Thyroid Swelling MNG/ SNT/None	Dysp-nea	Dysph-agia	Hoarse-ness	Regional Lymph Node metastasis	Vocal cord palsy	Distant Meta-stasis	FNAC	Treatment	Histo-pathology	Out-come
1	Girija	35	F	3529/05	MNG	-	-	-	-	-	-	Papillary Ca	Subtotal thyroidectomy	Medullary Ca	alive
2	Ramani	31	F	9896/05	R SNT	+	+	+	-	+	-	Papillary Ca	Total thyroidectomy	Papillary Ca	alive
3	Sathyabama	30	F	13791/05	MNG	-	-	-	-	-	-	Collid goiter	Subtotal thyroidectomy	Micropapillary Ca	alive
4	Rani	24	F	15437/05	MNG	+	-	+	-	-	-	Cystic macrophages & Inflammatory cells in fibrinous background	Subtotal thyroidectomy with (L) Paratracheal dissection	Papillary Ca	alive
5	Kullammal	40	F	4612/05	R SNT	-	-	-	-	-	-	To rule out neoplasm	R Hemithyroidectomy	Medullary Ca	alive
6	Govindammal	27	F	19758/05	None	-	-	-	+	-	-	Occult papillary Ca	Total thyroidectomy with R FND	Occult papillary Ca	alive
7	Radha	26	F	5057/05	MNG	+	+	-	+	-	-	Adenomatous goiter	R Hemithyroidectomy with MRND	Papillary Ca with Hashimoto's thyroiditis	alive
8	Sarasu	58	F	172508/05	R SNT	+	-	-	-	-	-	To rule out follicular neoplasm	R Hemithyroidectomy	Papillary Ca	alive

9	Pavuru	55	F	23826/05	R SNT	-	-	-	-	-	-	To rule out follicular neoplasm	R Hemithyroidectomy followed by completion thyroidectomy	Minimally invasive follicular Ca	alive
10	Vijaya	35	F	24879/05	MNG	-	-	-	-	-	-	Nodular goiter	Near total thyroidectomy	Papillary Ca	alive
11	Indira	27	F	24710/05	MNG	-	-	-	-	-	-	Hyperplastic nodule in goiter	Subtotal thyroidectomy	Papillary Ca (solid variant)	alive
12	Manonmani	20	F	25393/05	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca (solid variant)	alive
13	Rajeshwari	30	F	27383/05	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
14	Sankala	30	F	32783/05	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca (encapsulated variant)	alive
15	Tamilselvi	25	F	798763/05	L SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with B/L RND	Papillary Ca (columnar type)	alive
16	Ravi	45	F	8008791/05	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy B/L paratracheal dissection	Papillary Ca (follicular variant)	alive
17	Govindammal	60	F	804736/05	MNG (with ovarian tumor, with skin infiltration)	-	-	-	+	-	-	Papillary Ca	Trucut Biopsy Radiotherapy	Papillary Ca with skin deposits	alive

18	Ganesan	50	M	835408/05	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with L MRND	Papillary Ca	alive
19	Ganesan	50	M	805478/05	R SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with R FND	Papillary Ca	alive
20	Najitha Banu	20	F	805174/05	R SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with R posterolateral dissection	Papillary Ca	alive
21	Benazir	22	F	810201/05	R SNT	-	-	-	+	-	-	Papillary Ca	Completion thyroidectomy with R MRND	Papillary Ca	alive
22	Farhana	27	F	814461/05	L SNT	-	-	-	+	-	-	Nodular goiter	1st L hemithyroidectomy followed by completion thyroidectomy with L FND	Medullary Ca	alive
23	Kasthuri	17	F	813641/05	(L) SNT	-	-	-	-	-	-	Papillary Ca	Completion thyroidectomy with (L) Paratracheal dissection	Papillary Ca	alive
24	Ekambaram	78	M	812154/05	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with B/L FND	Papillary Ca	alive
25	Jaya	28	F	816621/05	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca with Hashimoto's thyroiditis	alive
26	Meena	58	F	816907/05	(R) SNT	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with (R) paratracheal dissection	Papillary Ca	alive

27	Kanniappan	60	M	819157/05	MNG	+	+	+	-	+	-	Anaplastic Ca	Trucut Biopsy Radiotherapy and Chemotherapy	Anaplastic Ca	death
28	Poongothai	35	F	820595/05	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca	alive
29	Kamatchi	47	F	823434/05	(L) SNT	-	-	-	-	-	-	Papillary Ca	Completion thyroidectomy	Papillary Ca	alive
30	Santhikala	29	F	823582/05	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (R) FND	Papillary Ca	alive
31	Govindammal	27	F	824409	(R) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with B/L FND	Papillary Ca	alive
32	Selvi	26	F	824892	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca (follicular variant)	
33	Kamala	37	F	8361/06	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (L) FND	Papillary Ca	alive
34	Umamaheswari	20	F	14307/06	MNG	-	-	-	-	-	-	Goitrous lesion	Total thyroidectomy	Papillary Ca (follicular variant)	alive
35	Murugan	47	M	17173/06	(L) SNT	-	-	-	-	-	-	Nodular goitre	(L) Hemithyroidectomy	Medullary Ca	alive
36	Rasool	22	M	183933/06	(L) SNT	-	-	-	-	-	-	Goitre	(L) hemithyroidectomy	Papillary Ca (follicular variant)	alive
37	Raaji	46	F	20010/06	(R) SNT	-	-	-	-	-	-	Cystic change in colloid goitre	(R) hemithyroidectomy	Papillary Ca with evolving thyroiditis	alive
38	Tirumaran	26	M	32160/06	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca	alive

39	Arulmozhi	16	F	34426/06	(R) SNT	-	-	-	-	-	-	Nodular goitre	(R) Hemithyroidectomy	Papillary Ca (follicular variant)	alive
40	Nirmala	32	F	837659/06	(L) SNT	-	-	-	-	-	-	Notular goitre	(L) Hemithyroidectomy	Papillary Ca	alive
41	Saraswathy	40	F	837297/06	(L) SNT	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
42	Adhilakshmi	38	F	840389/06	(R) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (R) FND	Papillary Ca	alive
43	Kanniappan	24	M	841139/06	(L) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (L) FND	Papillary Ca	alive
44	Rani	48	F	841036/06	(L) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (L) FND	Papillary Ca	alive
45	Guruswamy	58	M	845966/06	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (R) RND	Papillary Ca	alive
46	Pitchandi	32	M	844370/06	(R) SNT	-	-	-	-	-	-	Nodular goitre	(R) Hemithyroidectomy followed by completion thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
47	Latha	39	F	847685/06	(R) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (R) FND	Papillary Ca	alive

48	Irulayammal	65	F	850903/06	MNG	+	+	+	-	+	+ (Iliac Bone Mass)	Anaplastic Ca	Total thyroidectomy	Anaplastic Ca (spindle cell variant)	death
49	Lalitha	60	F	852794/06	(L) SNT	-	-	-	+	-	-	Nodular goitre	Completion thyroidectomy with B/L paratracheal dissection	Medullary Ca	alive
50	Kristaiah	42	M	850179/06	(R) SNT	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with B/L FND	Papillary Ca	alive
51	Padma	55	F	854033/06	MNG	-	-	-	-	-	-	To rule out neoplasm	Trucut biopsy chemotherapy radiotherapy	Large cell lymphoma	alive
52	Suji	27	F	860123/06	(R) SNT	-	-	-	-	-	-	Papillary Ca	Completion thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
53	Leonard	68	M	859679/06	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (R) RND with deltopctoral flap	Papillary Ca	alive
54	Kannamma	45	F	3702/07	(R) SNT	-	-	-	-	-	-	Colloid nodule	Total thyroidectomy	Micropapillary Ca	alive
55	Janaki	28	F	7341/07	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca	alive
56	Kondammal	48	F	6769/07	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy	Papillary Ca	alive
57	Sabarathinam	13	M	8859/07	MNG	-	-	-	-	-	-	Dyshormonogenetic goitre	Total thyroidectomy	Papillary Ca	alive
58	Geetha	26	F	11452/07	(R) SNT	-	-	-	-	-	-	Nodular goitre	Near total thyroidectomy	Papillary Ca	alive
59	Girija	40	F	13289/07	MNG	-	-	-	-	-	-	Follicular Neoplasm	Total thyroidectomy	Medullary Ca	alive

60	Susheela	40	F	862281/07	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (L) FND	Papillary Ca	alive
61	Suresh	30	M	863388/07	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with (R) paratracheal dissection	Micro Papillary Ca	alive
62	Shyamala	20	F	868272/07	MNG	-	-	-	-	-	-	Papillary Ca	Subtotal thyroidectomy	Papillary Ca	alive
63	Vellaisamy	45	M	531892/07	(R) SNT	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
64	Hussaini Basha	43	M	8675491/07	(R) SNT	-	-	-	-	-	-	Papillary Ca	Completion thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
65	Umaiyal	27	F	868820/07	MNG	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
66	Gnanaprakasam	60	M	868585/07	MNG (post radiothe-rapy)	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
67	Lakshmi	57	F	870638/07	MNG	-	-	-	+	-	-	Papillary Ca	Total thyroidectomy with (L) FND	Micropapillary Ca	alive

68	Kasthuri	64	F	872081/07	None	-	-	-	+ (nodal recurrence)	-	-	Papillary Ca	Completion (L) thyroidectomy with type II (R) MRND followed by split skin graft	Papillary Ca	alive
69	Latha	39	F	871067/07	None	-	-		+ (nodal recurrence)	-	-	Papillary Ca	(R) MRND Type II	Papillary Ca	alive
70	Ganga	38	F	873984/07	(L) SNT	-	-	-	-	-	-	Papillary Ca	Completion (L) thyroidectomy	Papillary Ca	alive
71	Lavanya	22	F	872086/07	(R) SNT	-	-	-	-	-	-	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive
72	Thilagavathy	48	F	873839/07	MNG	-	-	-	-	-	+ (sacral metastases)	Papillary Ca	Total thyroidectomy with B/L paratracheal dissection	Papillary Ca	alive

FND **:** Functional Neck Dissection

MRND **:** Modified Radical Neck Dissection

MNG **:** Multinodular Goitre

FNAC **:** Fine Needle Aspiration Cytology

RND **:** Radical Neck Dissection

SNT **:** Solitary nodule of thyroid

R & L **:** Right and Left